Wrdelud -105 / Park - 195

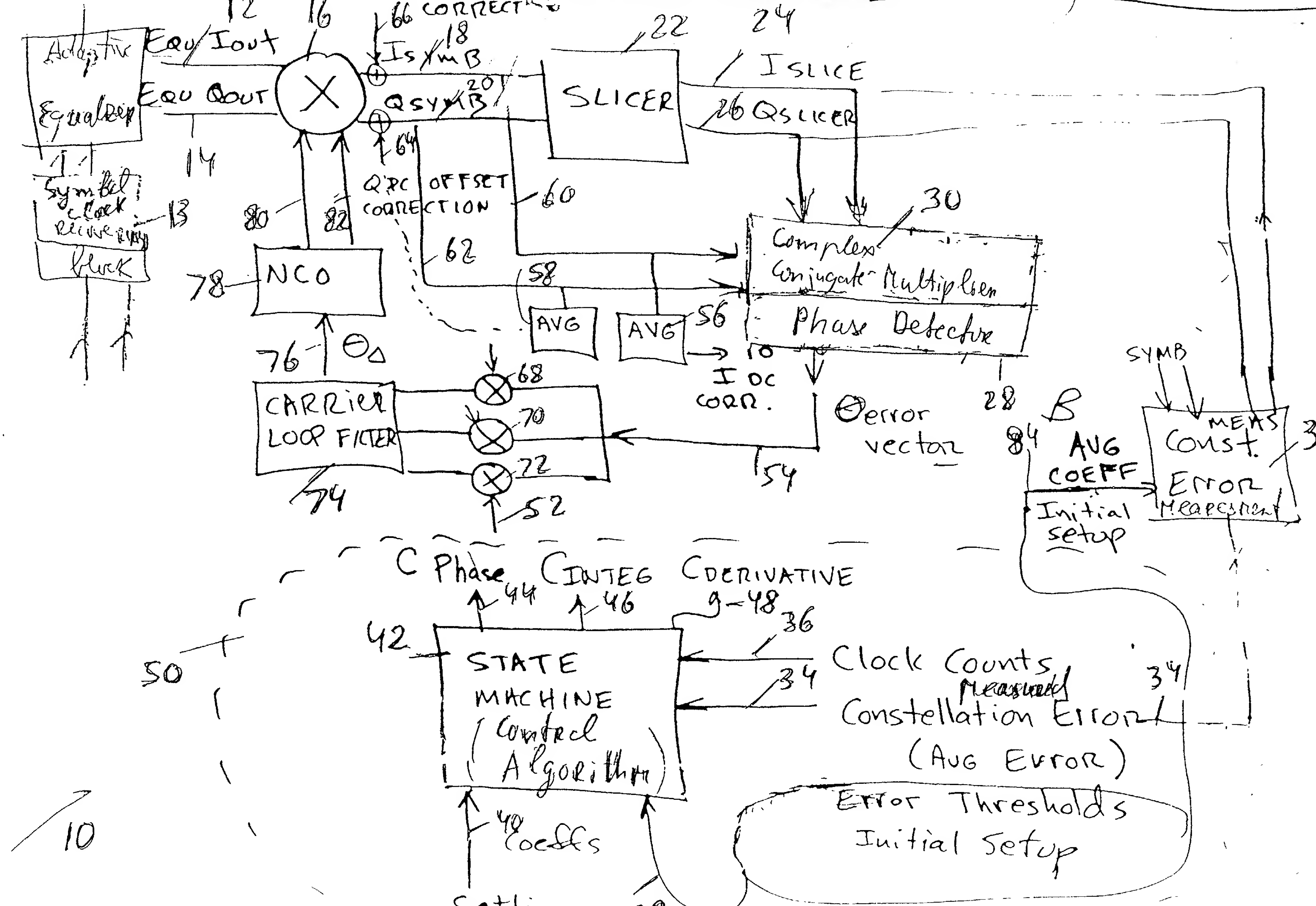
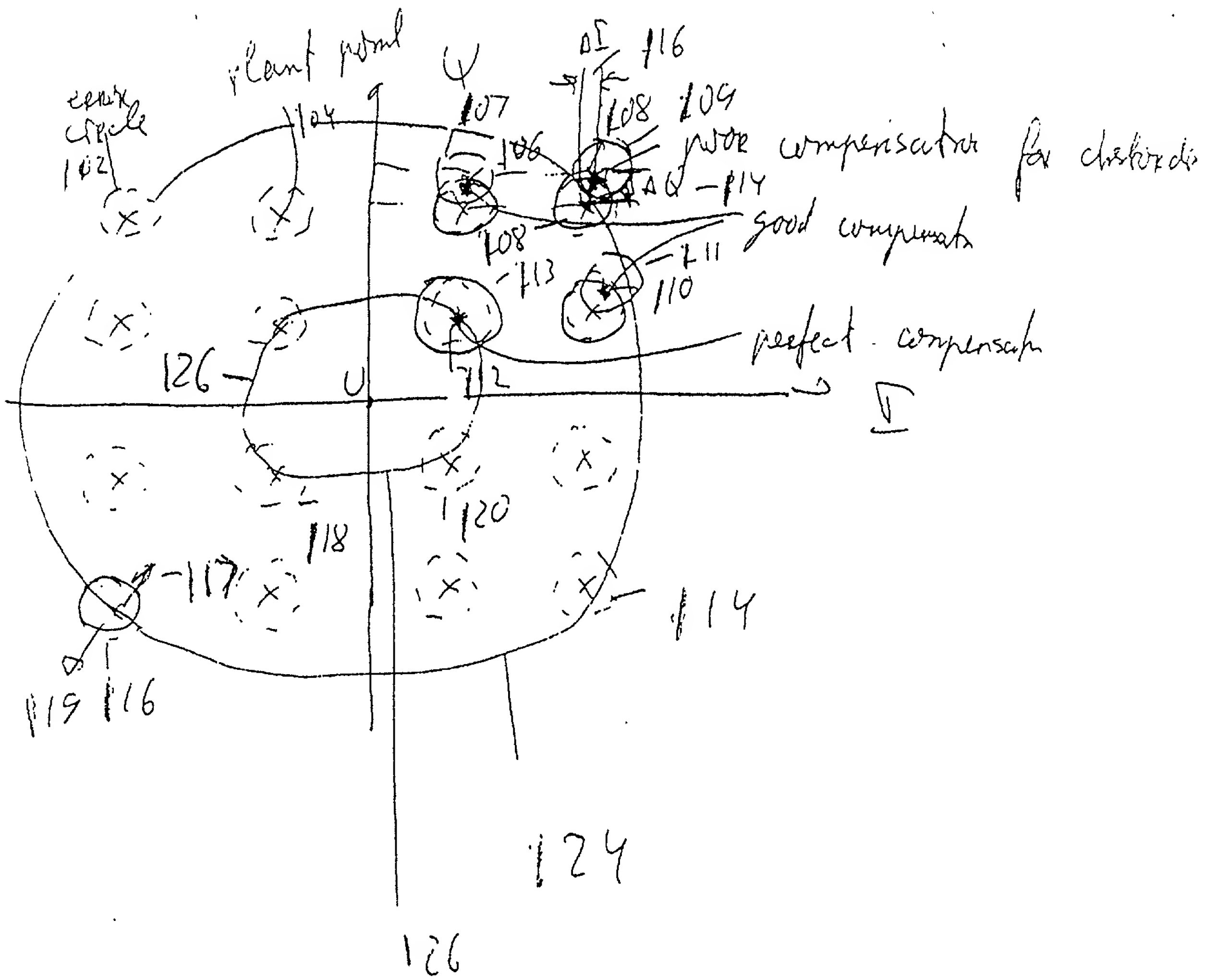


FIG. 1



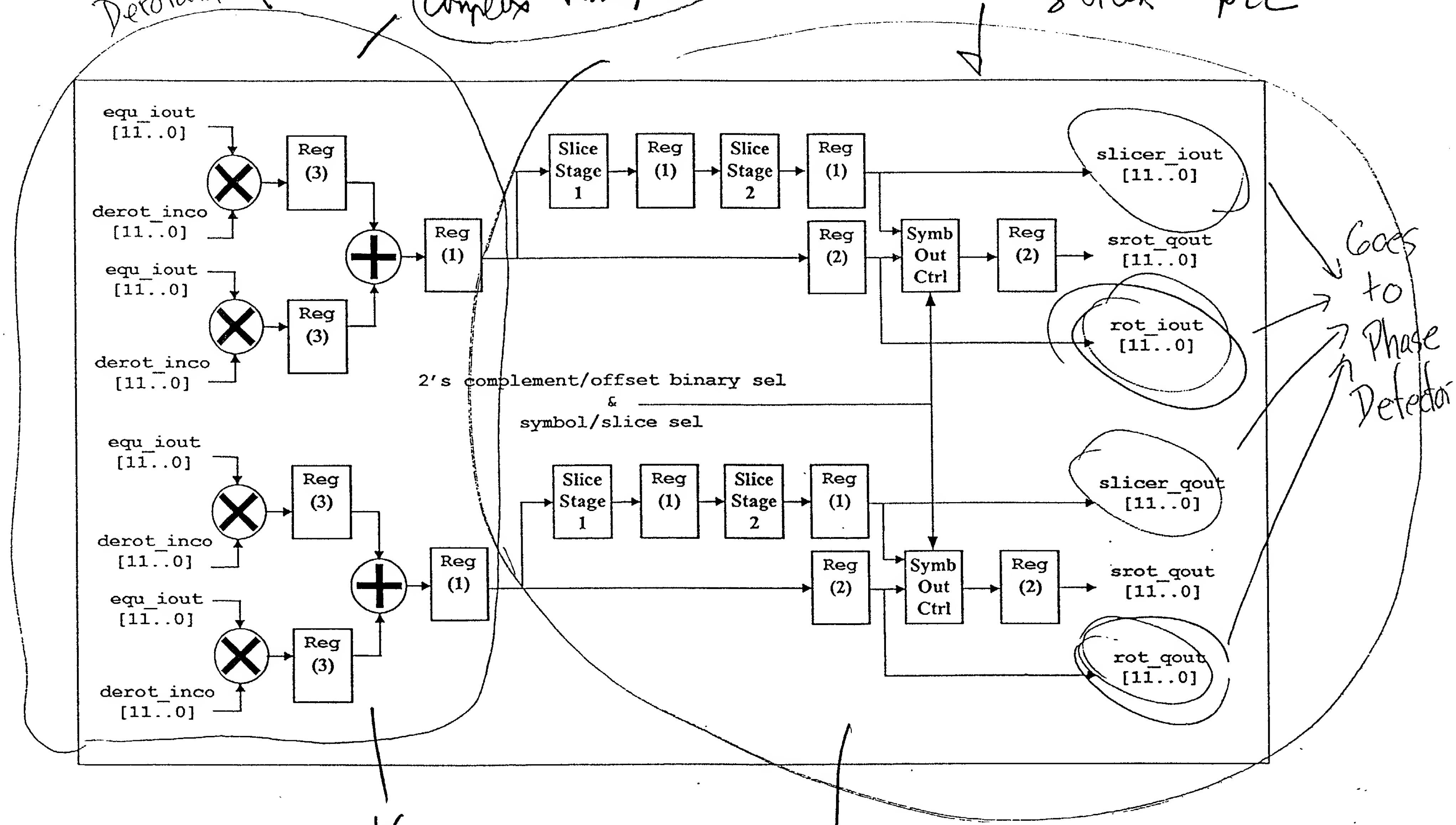
error circle
102
plant point
104
107
106
ΔI
116
108
109
poor compensation for distortion
ΔQ
114
good compensation
108
113
111
110
perfect compensation
112
I
Q
126
118
120
117
114
119
116
124
100
126

FIG. 2

No this is not the complex multiplier used in the slicer PLL

Derotator (H)

Complex Multiplier



Carrier Derotation

FIG. 3

10910385.101101

Wordeland-105/Park-195

Complex conjugate multipler missing (E)

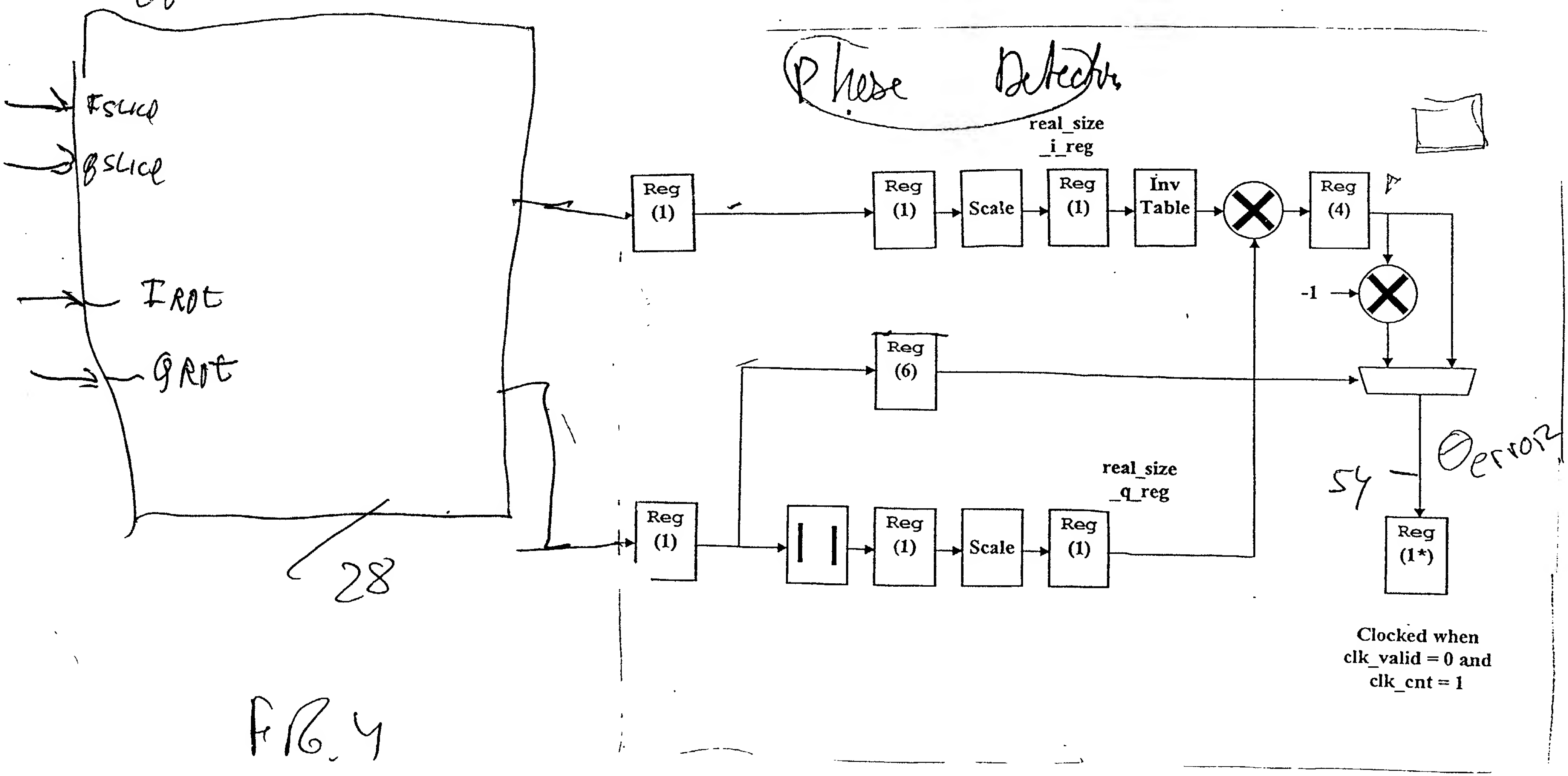


FIG. 4

Wrelated-105/Vank-195

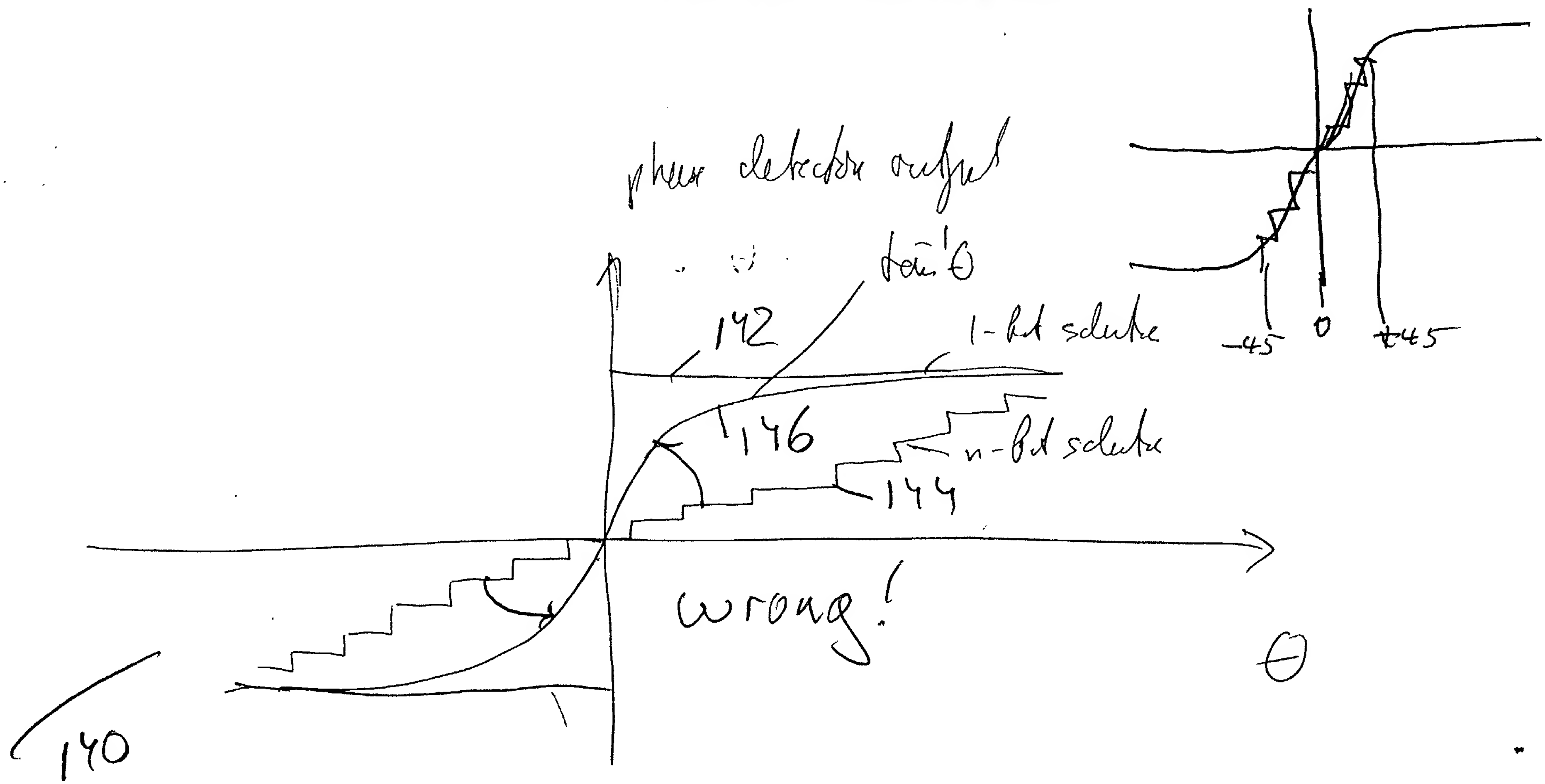


FIG. 5A

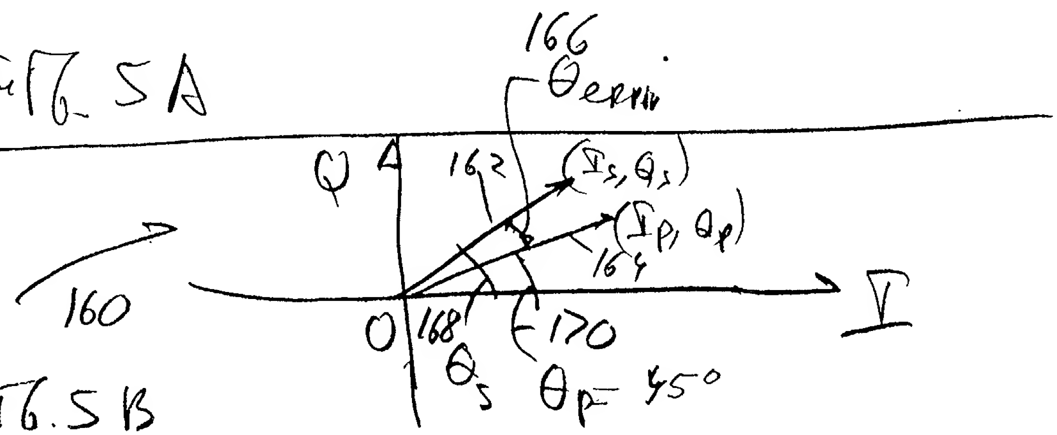
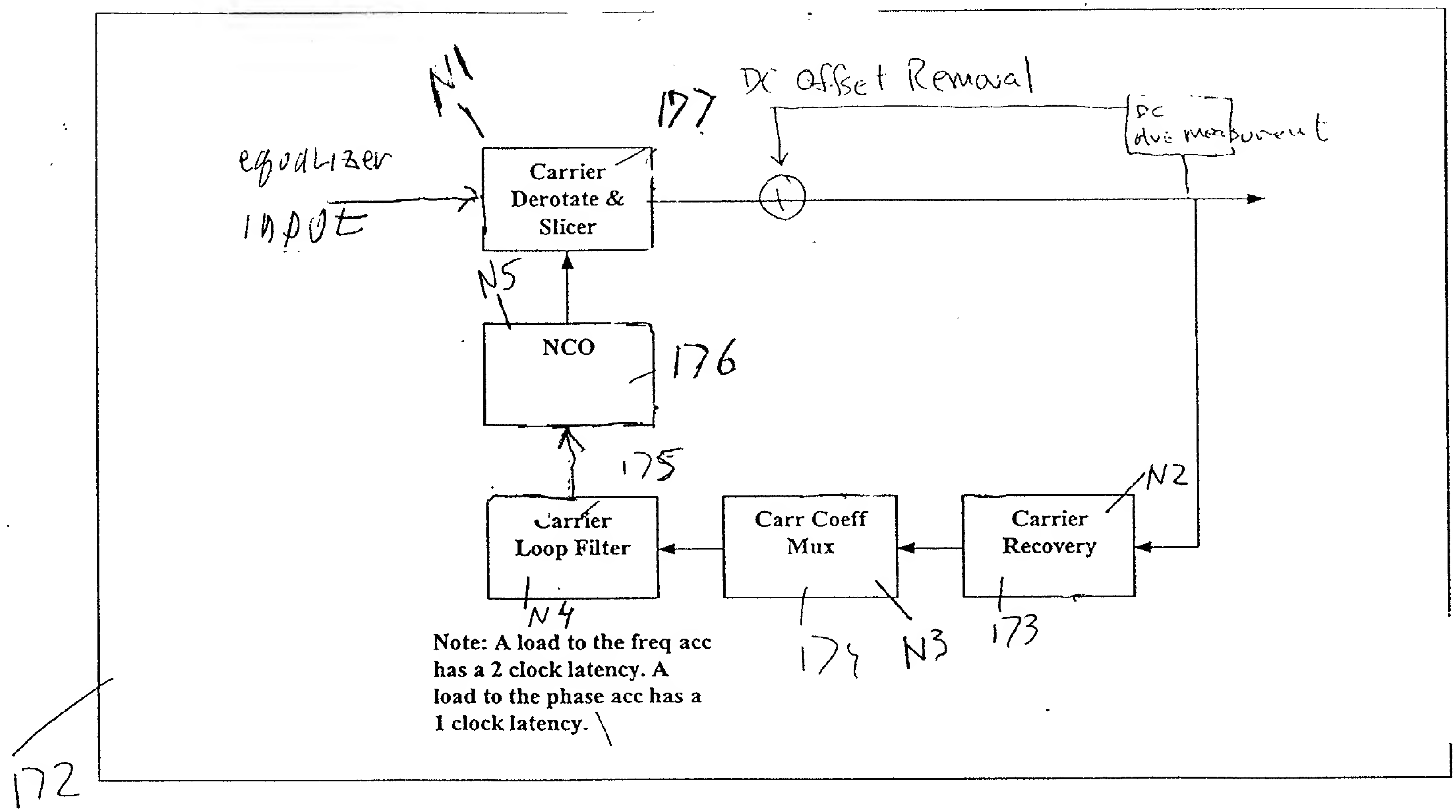


FIG. 5B



Total Loop Latency

FIG 5C

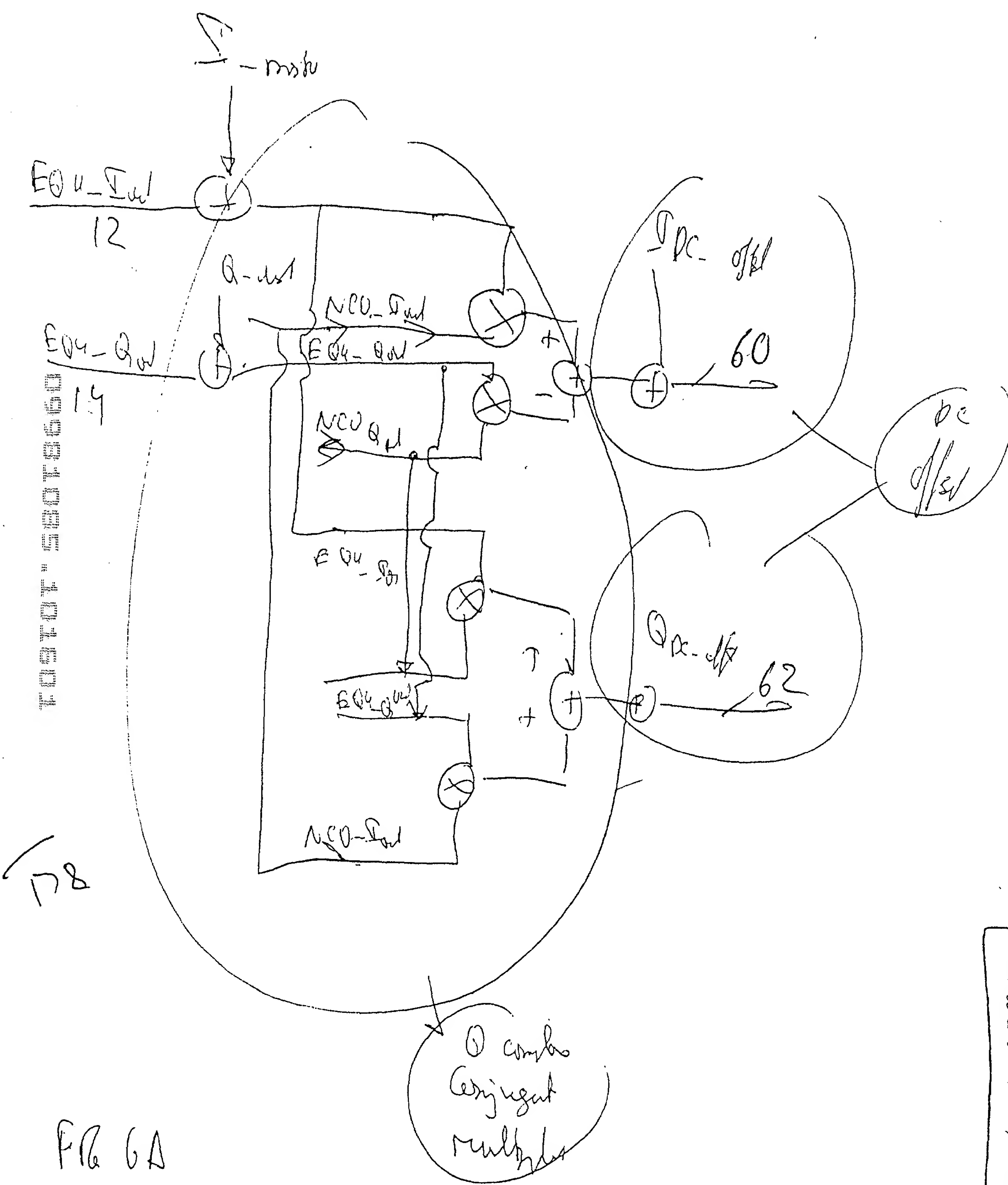
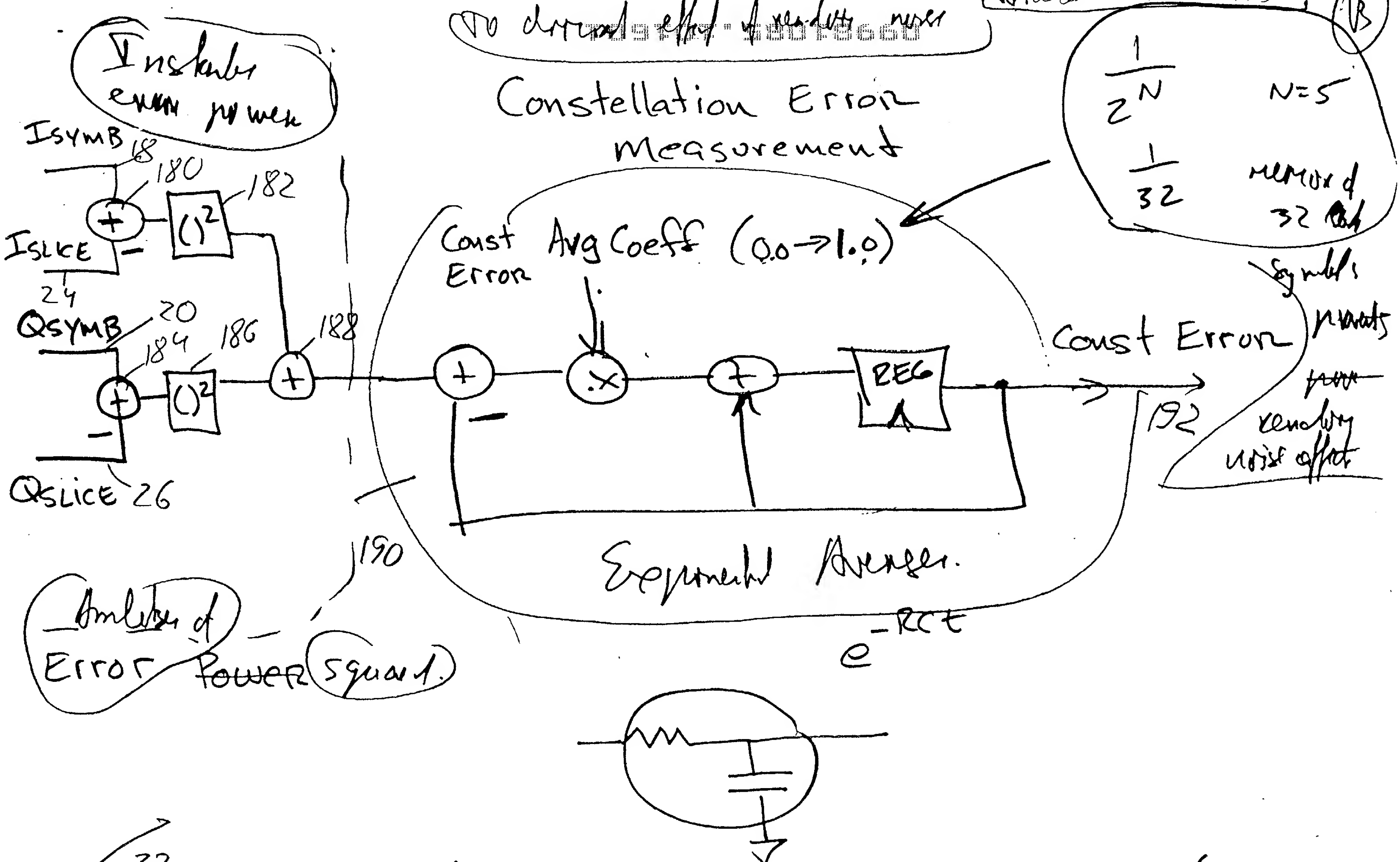


FIG 6A



32

if (AVG COEFF = Ø) OUTPUT is HELD (INPUT IGNORED)
if (AVG COEFF = 1) OUTPUT = INPUT
else OUTPUT is EXPONENTIAL AVG OF INPUTS

FIG. 6B

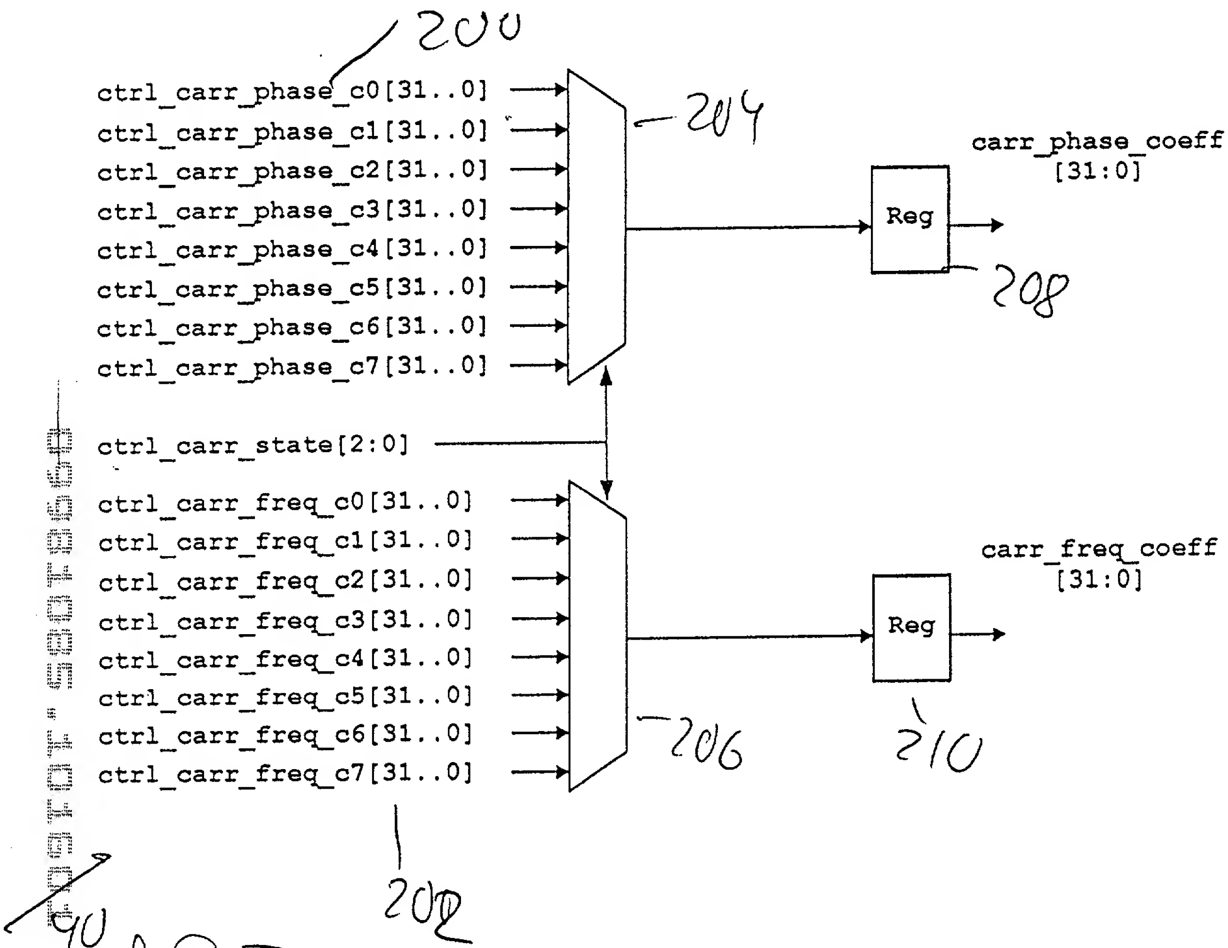

200
ctrl_carr_phase_c0[31..0]
ctrl_carr_phase_c1[31..0]
ctrl_carr_phase_c2[31..0]
ctrl_carr_phase_c3[31..0]
ctrl_carr_phase_c4[31..0]
ctrl_carr_phase_c5[31..0]
ctrl_carr_phase_c6[31..0]
ctrl_carr_phase_c7[31..0]
204
carr_phase_coeff [31:0]
Reg
208
ctrl_carr_state[2:0]
ctrl_carr_freq_c0[31..0]
ctrl_carr_freq_c1[31..0]
ctrl_carr_freq_c2[31..0]
ctrl_carr_freq_c3[31..0]
ctrl_carr_freq_c4[31..0]
ctrl_carr_freq_c5[31..0]
ctrl_carr_freq_c6[31..0]
ctrl_carr_freq_c7[31..0]
carr_freq_coeff [31:0]
Reg
206
210
202
90

FIG. 7

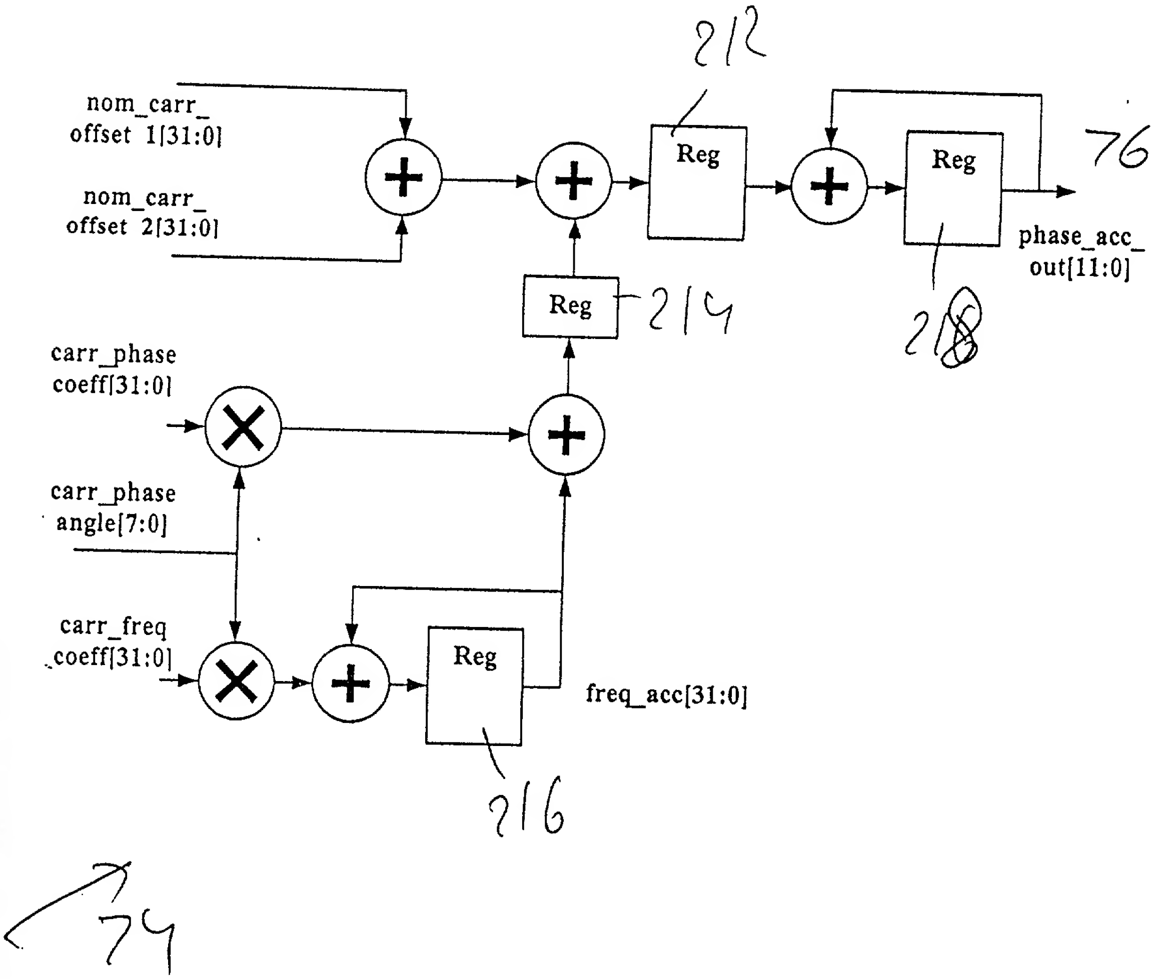


FIG 8. Carrier Loop Filter

wdda-105 /Dat-/95

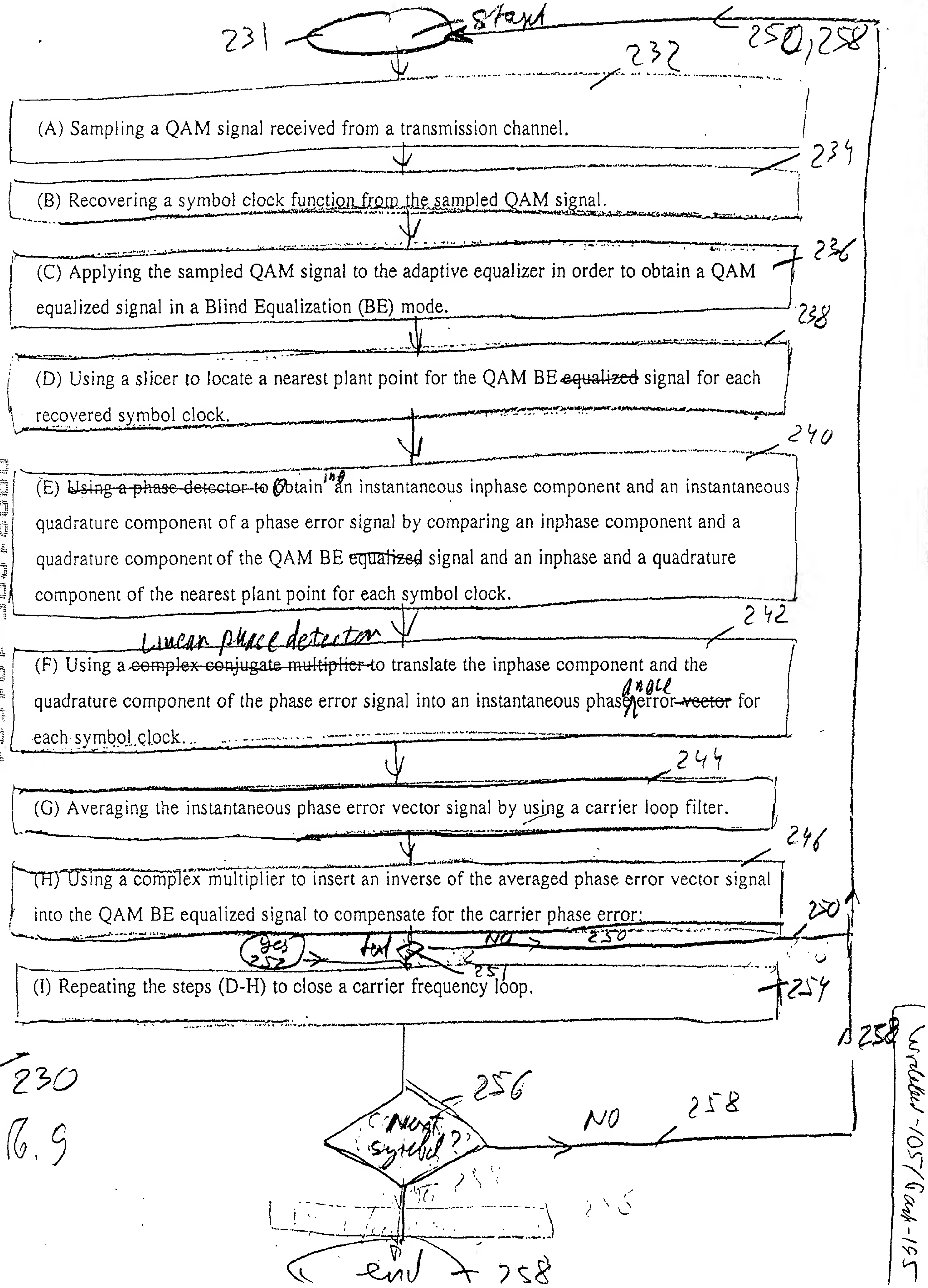

start
231
250, 258
232
(A) Sampling a QAM signal received from a transmission channel.
234
(B) Recovering a symbol clock function from the sampled QAM signal.
236
(C) Applying the sampled QAM signal to the adaptive equalizer in order to obtain a QAM equalized signal in a Blind Equalization (BE) mode.
238
(D) Using a slicer to locate a nearest plant point for the QAM BE ~~equalized~~ signal for each recovered symbol clock.
240
(E) ~~Using a phase detector to~~ Obtaining an instantaneous inphase component and an instantaneous quadrature component of a phase error signal by comparing an inphase component and a quadrature component of the QAM BE ~~equalized~~ signal and an inphase and a quadrature component of the nearest plant point for each symbol clock.
242
(F) Using a ~~complex conjugate multiplier~~ Linear phase detector to translate the inphase component and the quadrature component of the phase error signal into an instantaneous phase angle error ~~vector~~ for each symbol clock.
244
(G) Averaging the instantaneous phase error vector signal by using a carrier loop filter.
246
~~(H) Using a complex multiplier to insert an inverse of the averaged phase error vector signal into the QAM BE equalized signal to compensate for the carrier phase error.~~
250
yes 252
test
NO
250
251
(I) Repeating the steps (D-H) to close a carrier frequency loop.
254
258
256
Next symbol?
NO
258
end
258
Wrobleski-1057/Cash-165
230

FIG. 9

Selecting an initial set of PID coefficients by using the state machine to set the variable bandwidth of the carrier loop filter to be higher than a frequency uncertainty during a QAM signal acquisition state of the QAM demodulator. 262

↓

Adjusting the initially selected set of PID coefficients by using the state machine in order to decrease the initially set bandwidth of the carrier loop filter in incremental stages to be less than the frequency uncertainty during a carrier tracking state of the QAM demodulator. 264

244

Step 6. – Normal Mode

FIG. 10

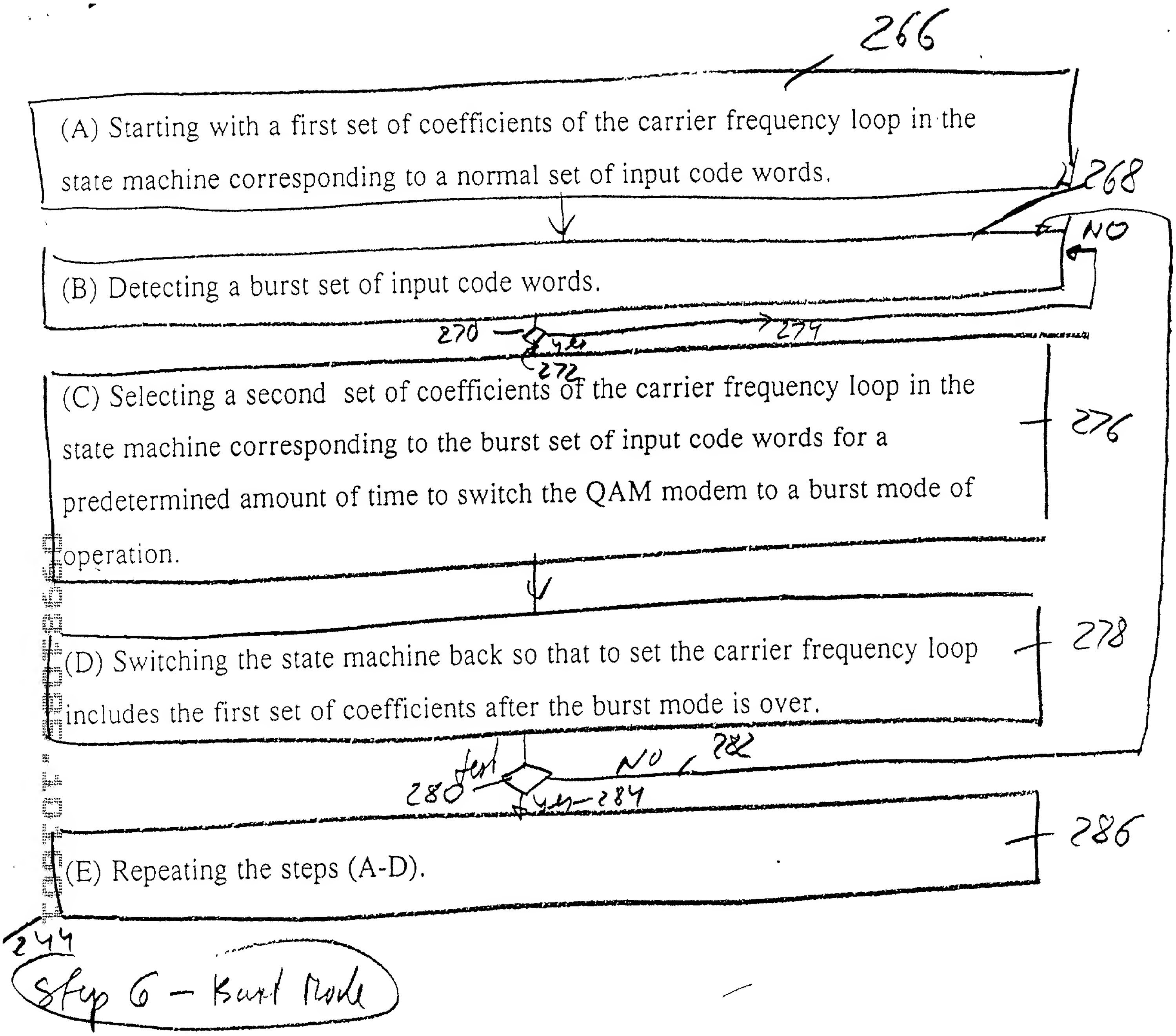

266
(A) Starting with a first set of coefficients of the carrier frequency loop in the state machine corresponding to a normal set of input code words.
268
NO
(B) Detecting a burst set of input code words.
270
yes
272
274
(C) Selecting a second set of coefficients of the carrier frequency loop in the state machine corresponding to the burst set of input code words for a predetermined amount of time to switch the QAM modem to a burst mode of operation.
276
(D) Switching the state machine back so that to set the carrier frequency loop includes the first set of coefficients after the burst mode is over.
278
280
NO
282
yes
284
(E) Repeating the steps (A-D).
286
244
Step 6 – Burst Mode

FIG. 11